

RTCA Special Committee 209

Working Group #1

Mode S Transponder MOPS Maintenance

Meeting #3

**Engility Corporation, Washington DC
2 – 4 October 2007**

**Detailing The Proposed Changes to Figures in
Order to Harmonize DO-181D and ED-73C**

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SUMMARY

This Working Paper builds from the beginning of comparison of the differences between Figures in both DO-181D and ED-73C in Working Paper SC209-WP07-09 which was briefly discussed in Brussels. This Working Paper attempts to give specifics that can be reviewed and agreed upon so that we can move forward toward having a single set of Visio files for the Figures in both documents.

Table of Figures in DO-181D and ED-73C

DO-181D Figures	DO-181D Titles	ED-73C Figures	ED-73C Titles	Status
Figure 2-01	General Pulse Pattern for PAM Interrogations	Figure 1-1	General Pulse Pattern for PAM Interrogations	Identical
Figure 2-02	General Pulse Patterns for DPSK Interrogations	Figure 1-2	DPSK Pulse Characteristics	Differences Acceptable
		Figure 3-1	Spectrum Limits for Mode S Transponder Transmitter	
Figure 2-03	Mode S Reply Waveform	Figure 3-2	Mode S Reply Waveform	Identical
Figure 2-04	Overview of Mode S Interrogation (Uplink) Formats	Figure 3-3	Overview of Mode S Interrogation (Uplink) Formats	ED-73 needs updating
Figure 2-05	Overview of Mode S Reply (Downlink) Formats	Figure 3-4	Overview of Mode S Reply (Downlink) Formats	ED-73 needs updating
Figure 2-06	Field Index	Figure 3-5A	Field Index (Uplink)	ED-73 needs updating
		Figure 3-5B	Field Index (Downlink)	ED-73 needs updating
Figure 2-07	Level 1 Transponder Uplink Formats	Figure 3-6	Level 1 Transponder Uplink Formats	Same content, different format
Figure 2-08	Level 1 Transponder Downlink Formats	Figure 3-7	Level 1 Transponder Downlink Formats	Same content, different format
Figure 2-09	Functional Diagram of Uplink Coding	Figure 3-8	Functional Diagram of Uplink Coding	Identical
Figure 2-10	Functional Diagram of Downlink Coding	Figure 3-9	Functional Diagram of Downlink Coding	Identical
Figure 2-11	The Level 1 Transponder: Interrogation Acceptance	Figure 3-10	The Level 1 Transponder: Interrogation Acceptance	Figure 2-11 updated to match Figure 3-10 for SI protocol
Figure 2-12	All Transponders: Lockout Initiation	Figure 3-11	All Transponders Lockout Initiation	Figure 2-12 updated to match Figure 3-11 for SIS=0
Figure 2-13	All Transponders: FS and VS Protocol	Figure 3-12	Flight Status and Vertical Status Protocols	Figure 3-12 is missing a “YES” under the “A” box
Figure 2-14	All Transponders: Reply Content	Figure 3-13	Reply Content	Figure 2-14 updated to match Figure 3-13
Figure 2-15	All Level 2 Transponders: Formats	Figure 3-14	Transponder Formats for Level 2 Transponder	Same content, different format
Figure 2-16	Data Link Transponders Interrogation Acceptance	Figure 3-15	Data Link Transponders Interrogation Acceptance	Figure 2-16 updated to match Figure 3-15 for SI protocol
Figure 2-17	All Level 2 Transponders Coordination	Figure 3-16	All Data Link Transponders: Coordination	Identical
Figure 2-18	All Level 2 Transponders UM Protocol	Figure 3-17	UM Protocol	“T _{RS} Timer Runs” in Fig 3-17 incorrect, should be T _{RB}
Figure 2-19	All Data Link Transponders B Protocol	Figure 3-18	Data Link Transponders: B-Protocol	Differences to be discussed
		Figure 3-18A	Enhanced Comm-B Protocol	
Figure 2-20	Comm-C Reservation and Closeout	Figure 3-19	Comm-C Reservation and Close Out	Identical
		Figure 3-19A	Enhanced Comm-C Reservation and Close Out	
Figure 2-21	Comm-C Message Handling	Figure 3-20	Comm-C Message Handling	We believe that Figure 3-20 should be replaced with Figure 2-21

DO-181D Figures	DO-181D Titles	ED-73C Figures	ED-73C Titles	Status
		Figure 3-20A	Enhanced Comm-C Message Handling	Should be carefully reviewed in light of the differences with Figure 2-21
Figure 2-22	Comm-D Reservation and Closeout	Figure 3-21	Comm-D Reservation and Closeout	Identical
		Figure 3-21A	Enhanced Comm-D Reservation and Closeout	
Figure 2-23	Comm-D Message Handling	Figure 3-22	Comm-D Message Handling	Figure 3-22 error in decision box E with Yes/No reversed
		Figure 3-22A	Enhanced Comm-D Message Handling	
Figure 2-24		Figure 5-1	Test Equipment Connection	Fig 5-1 matches Fig 2-24
Figure 2-25		Figure 5-2	Test Equipment Connection	Fig 5-2 matches Fig 2-25
Figure 2-26		Figure 5-3	Test Equipment Connection	Fig 5-3 matches Fig 2-26
Figure 2-27		Figure 5-5	Test Equipment Connection	Fig 5-5 matches Fig 2-27
Figure 2-28	(not referenced in DO-181C or D)			
Figure 2-29		Figure 5-6	Test Equipment Connection	Fig 5-6 matches Fig 2-29
Figure 2-30		Figure 5-7	Test Equipment Connection	Fig 5-7 matches Fig 2-30
Figure 2-31		Figure 5-8	Test Equipment Connection	Fig 5-8 matches Fig 2-31
Figure 2-32		Figure 5-4	Test Equipment Connection	Fig 5-4 matches Fig 2-32

Specific Details Regarding Differences in Figures:

1. Figure 3-3 in ED-73C needs to be updated by revising UF=19 as agreed to during Brussels meeting.
2. Figure 3-4 in ED-73C needs to be updated by revising DF=19 as agreed to during Brussels meeting.
3. Figures 3-5A and 3-5B in ED-73C for Uplink and Downlink Fields need to be updating by adding AF, CF, II and SI, as appropriate.
4. Figure 2-11 in DO-181D differed from Figure 3-10 in ED-73C because it appears that Figure 3-10 had been updated to add the decision boxes for SI protocol and Figure 2-11 had not been updated. Therefore Figure 2-11 is shown below as the original and Figure 2-11R1 is shown as modified to account for the addition of the blocks for SI protocol.

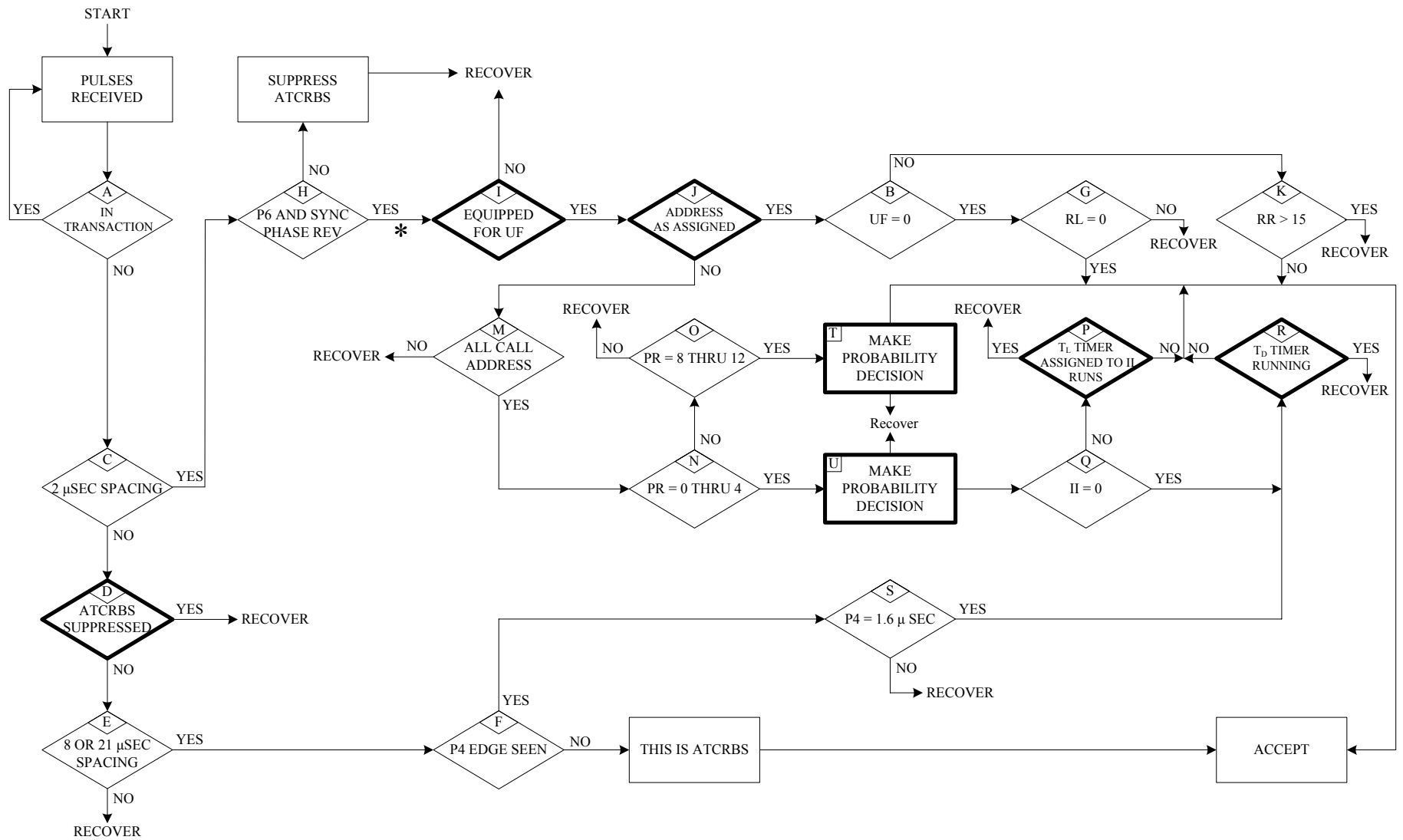
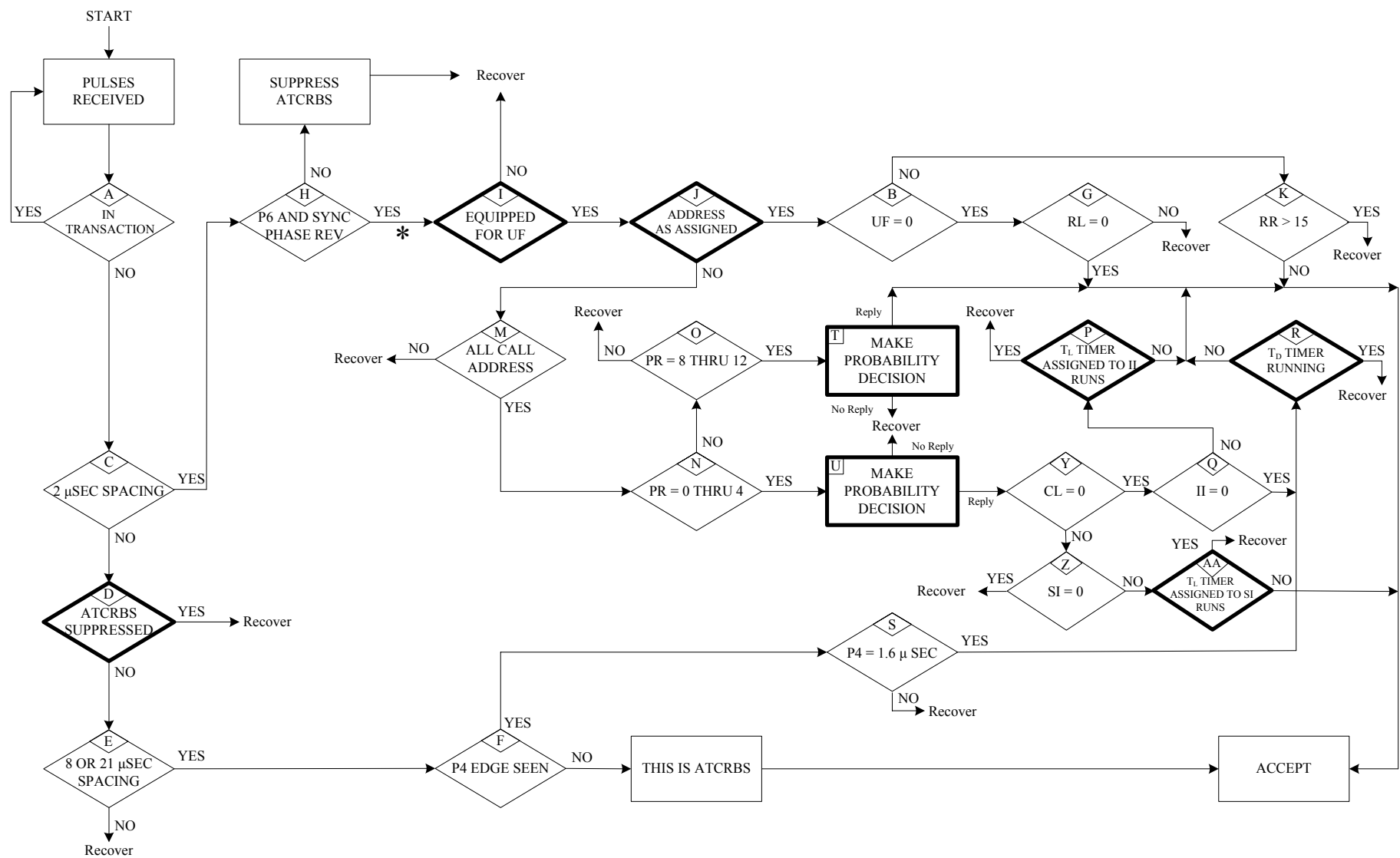


Figure 2-11: ORIGINAL FROM DO-181D, v1.1



Specific Details Regarding Differences in Figures (Continued):

5. Figure 2-12(A) in DO-181D differed from Figure 3-11 in ED-73C because it appears that Figure 3-11 had a decision box for SIS=0 and Figure 2-12(A) had not been updated. Therefore Figure 2-12(A) is shown below as the original, and Figure 2-12(A)R1 is shown as modified to account for the addition of the blocks for SIS=0.

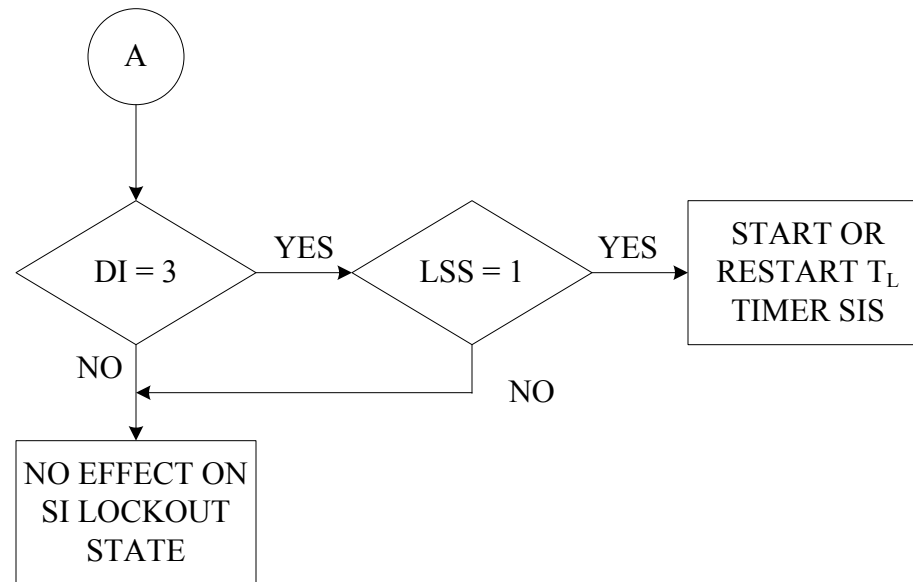


Figure 2-12(A): ORIGINAL FROM DO-181D, v1.1

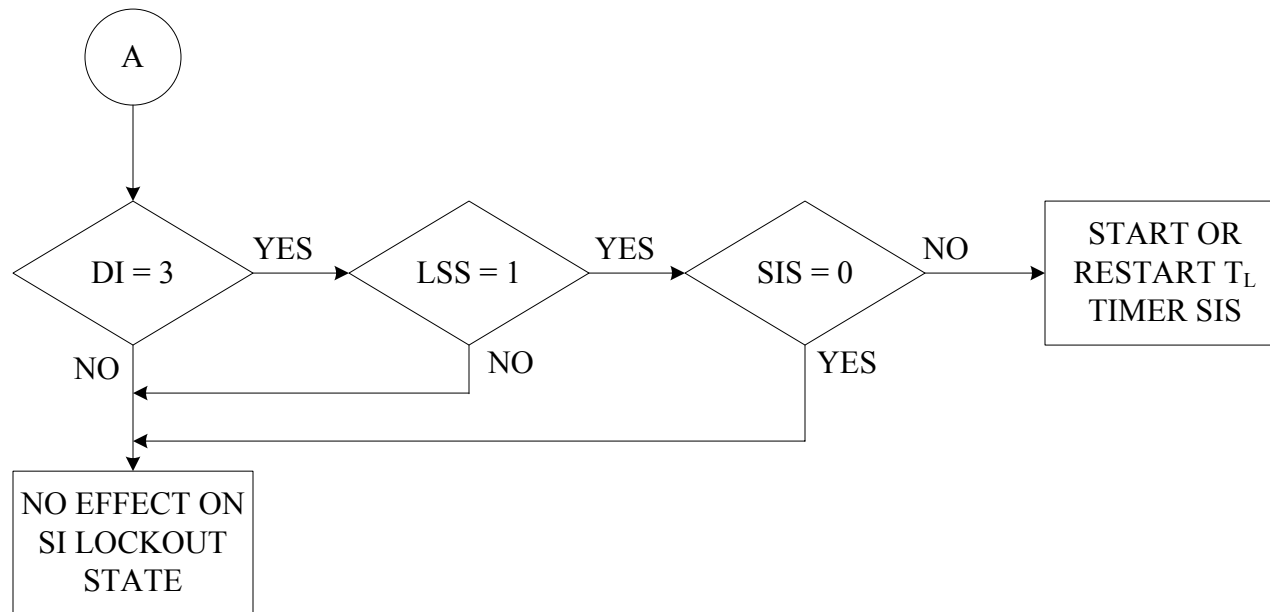


Figure 2-12(A)R1: WITH CHANGES PROPOSED TO HARMONIZE WITH ED-73C Figure 3-11 for SIS=0

Specific Details Regarding Differences in Figures (Continued):

6. Figure 3-12 in ED-73C is missing a “YES” decision on the right side of the figure coming out of the “A” box.
7. After analysis it appears that Figure 2-14 in DO-181D has several errors and that Figure 3-13 in ED-73C is correct. Therefore, Figure 2-14R1 is proposed to be updated to match Figure 3-13 as shown below.

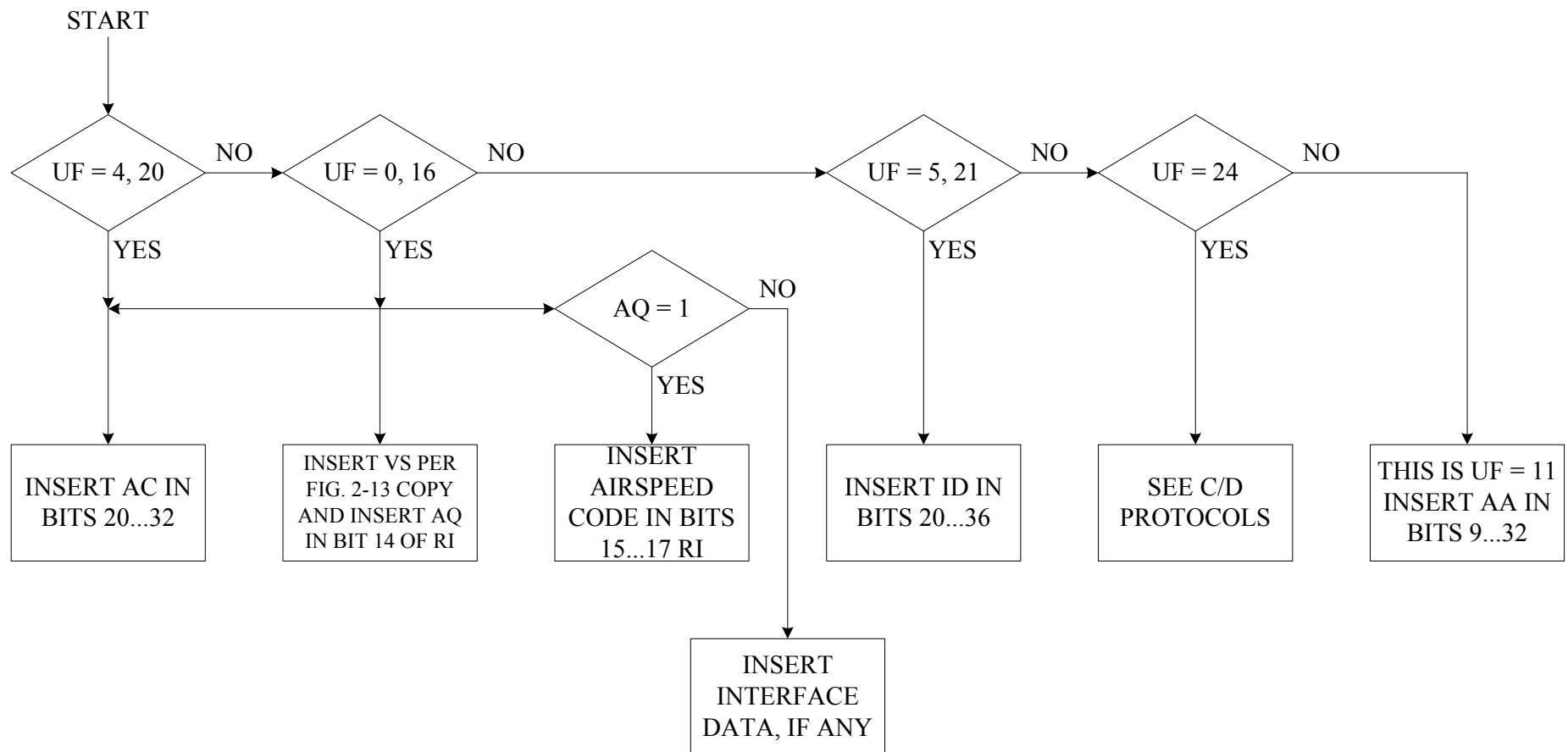


Figure 2-14: ORIGINAL FROM DO-181D, v1.1

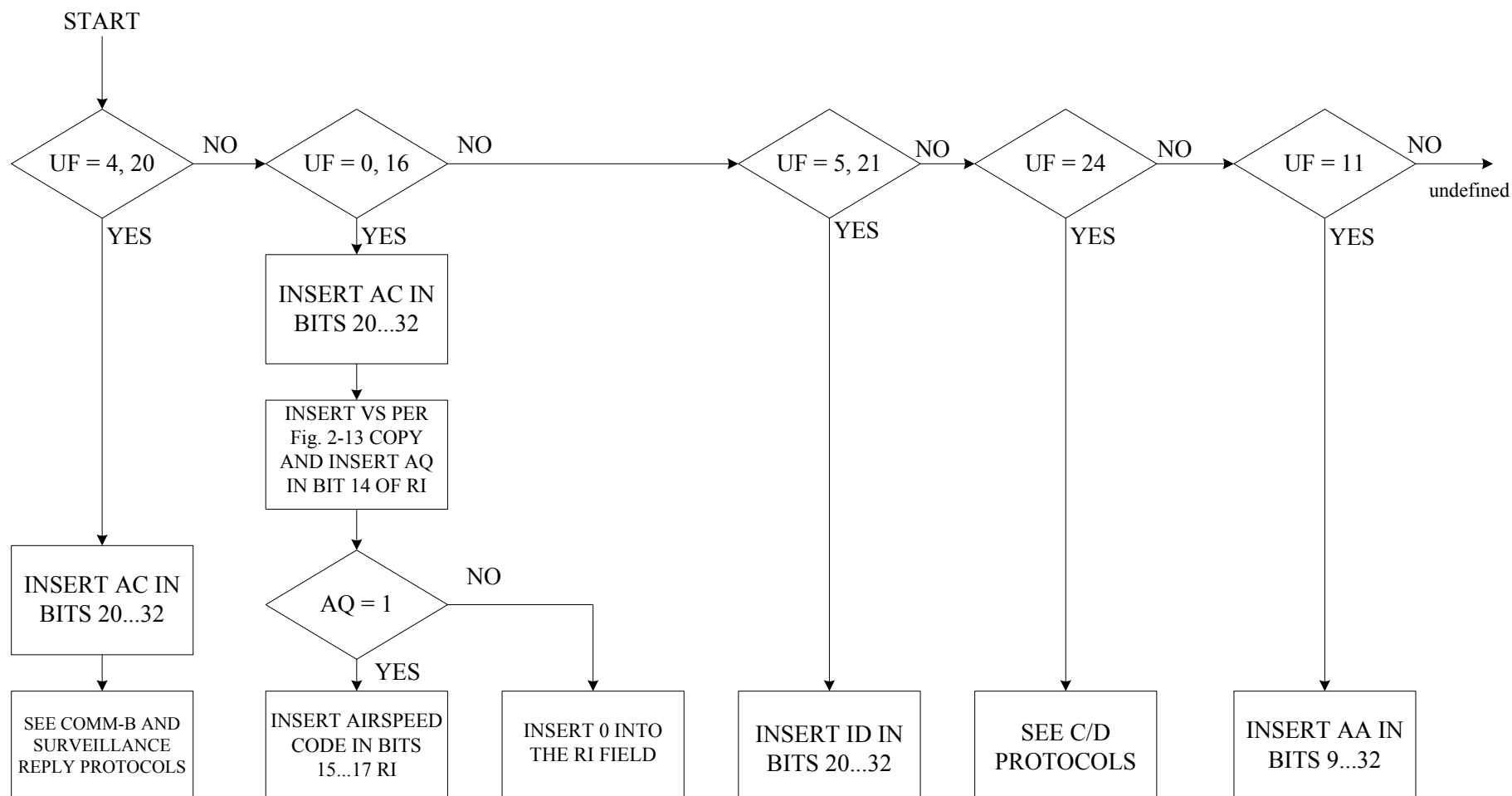


Figure 2-14R1: WITH CHANGES PROPOSED TO HARMONIZE WITH ED-73C Figure 3-13

Specific Details Regarding Differences in Figures (Continued):

8. Figure 2-16 in DO-181D differed from Figure 3-15 in ED-73C because it appears that Figure 3-15 had been updated to add the decision boxes for SI protocol and Figure 2-16 had not been updated. Therefore Figure 2-16 is shown below as the original and Figure 2-16R2 is shown as modified to account for the addition of the blocks for SI protocol. Figure 2-16R1 was presented during the Brussels meeting showing two “Option to Reply” decision boxes added by Tom Pagano, and are retained in Figure 2-16R2 below.

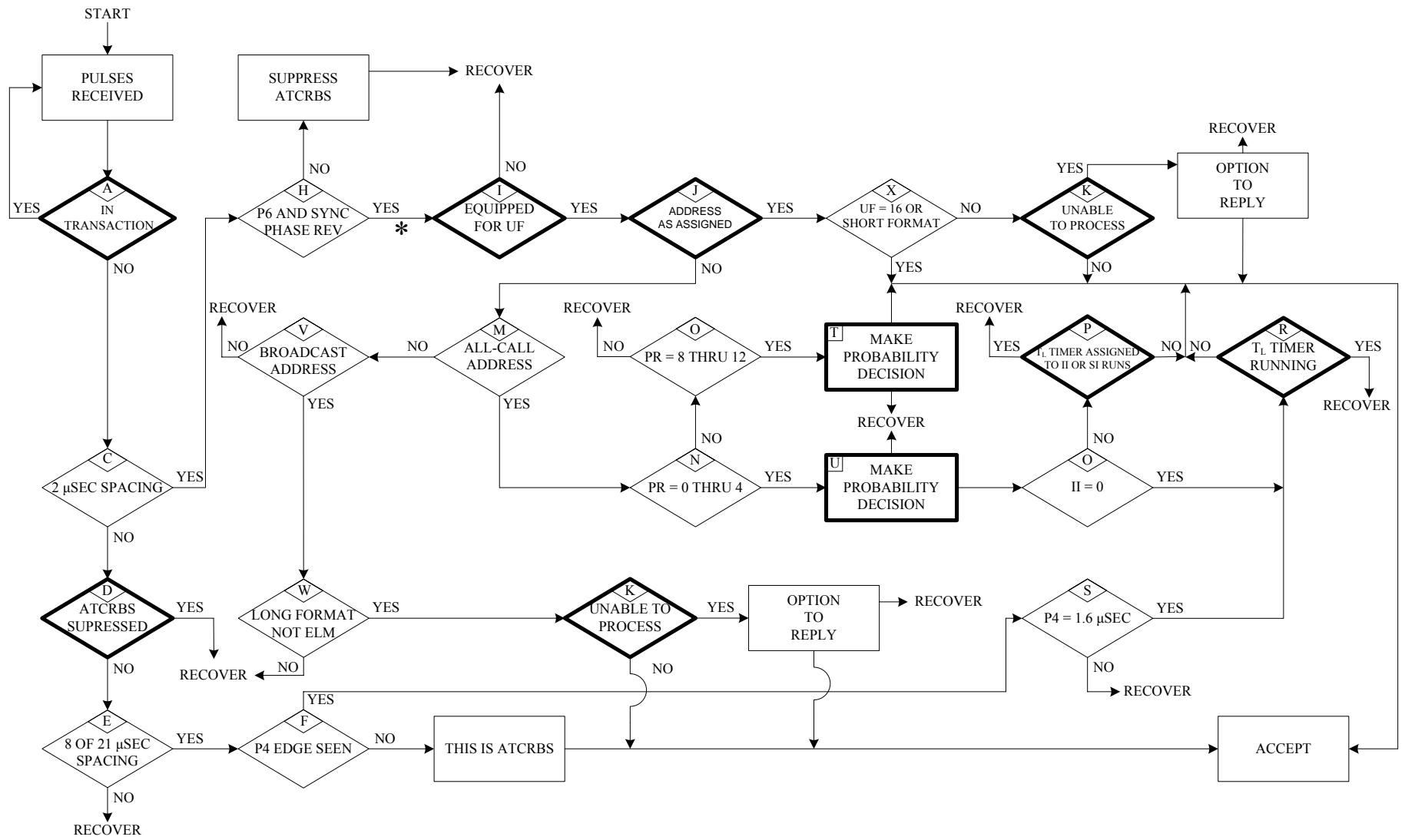


Figure 2-16R1: ORIGINAL FROM DO-181D, v1.1 in the Brussels Meeting

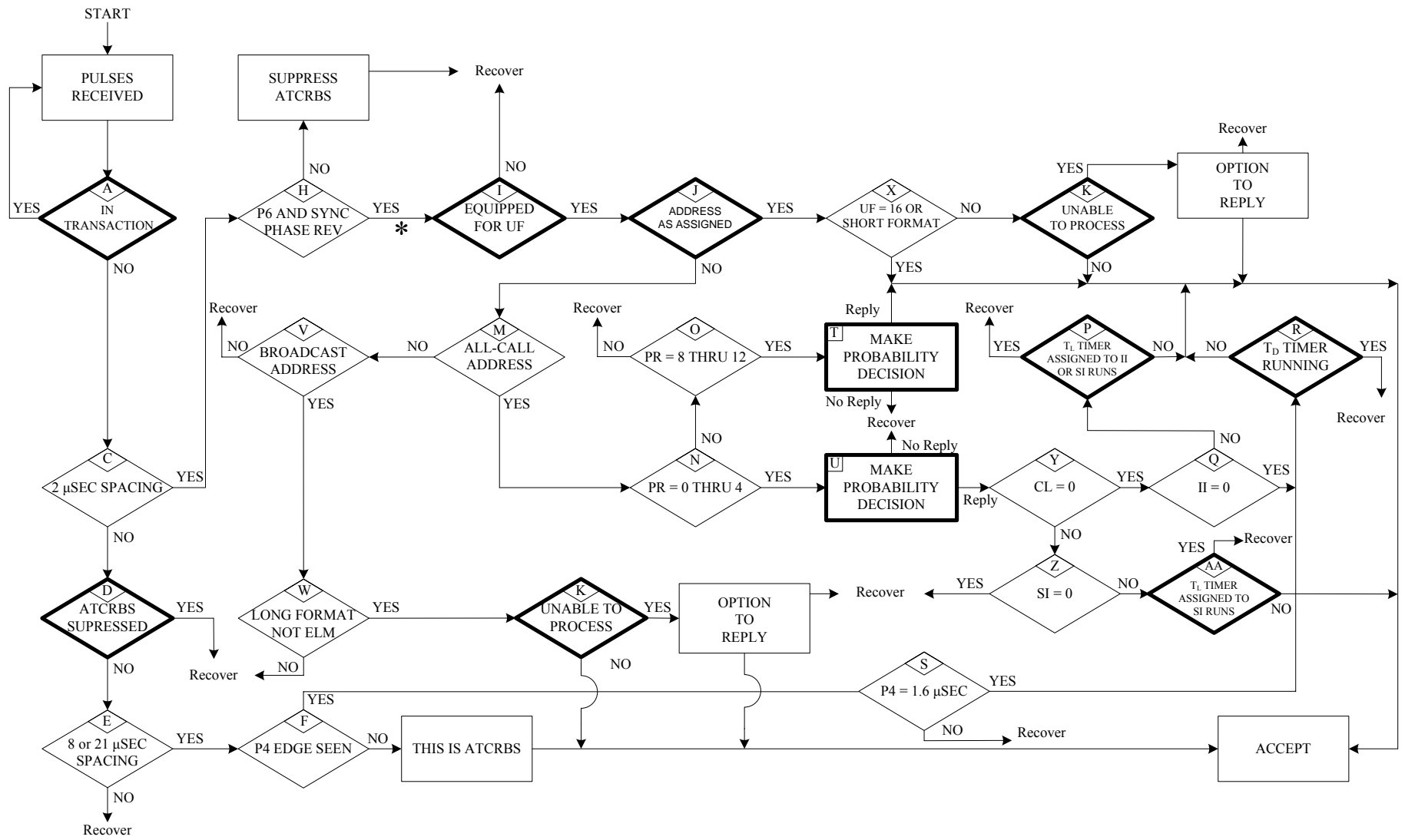


Figure 2-16R2: WITH CHANGES PROPOSED TO HARMONIZE WITH ED-73C Figure 3-15 with SI Protocol

Specific Details Regarding Differences in Figures (Continued):

9. Figure 3-17 in ED-73C has a decision box indicating that “ T_{RS} Timer Runs.” That is incorrect, and it should be “ T_{RB} Timer Runs” as in Figure 2-18 of DO-181D.
10. Figure 2-19 in DO-181D and Figure 3-18 and 18A in ED-73C will be the topic of many separate discussions and whatever the SC-209 decision is can be applied.
11. Figure 2-21 in DO-181D appears to have been updated at least once since Figure 3-20 in ED-73C, and we believe that Figure 2-21 is accurate, and represents the correct flow chart for Comm-C Message Handling. We recommend that Figure 3-20 in ED-73C be replaced with the current Figure 2-21 from the latest draft of DO-181D.
12. Figure 3-20A for Enhanced Comm-C Message Handling should be reviewed in detail, given the differences in Figure 2-21 and Figure 3-20. It is likely that Figure 3-20A will need to be revised on the same template as Figure 2-21.
13. Figure 3-22 in ED-73C has an error in the outputs of decision box “E” where the “YES” and “NO” are reversed. This is correct in Figure 2-23 in DO-181D. However, there is another error in Figure 2-23 in that whenever the TRD Timer runs out, the “D” Register should NOT be cleared as in the bottom box under the “Non-Synchronous” boxes on the extreme right of the figure. The original Figure 2-23 and the proposed revised Figure 2-23R1 appear below.

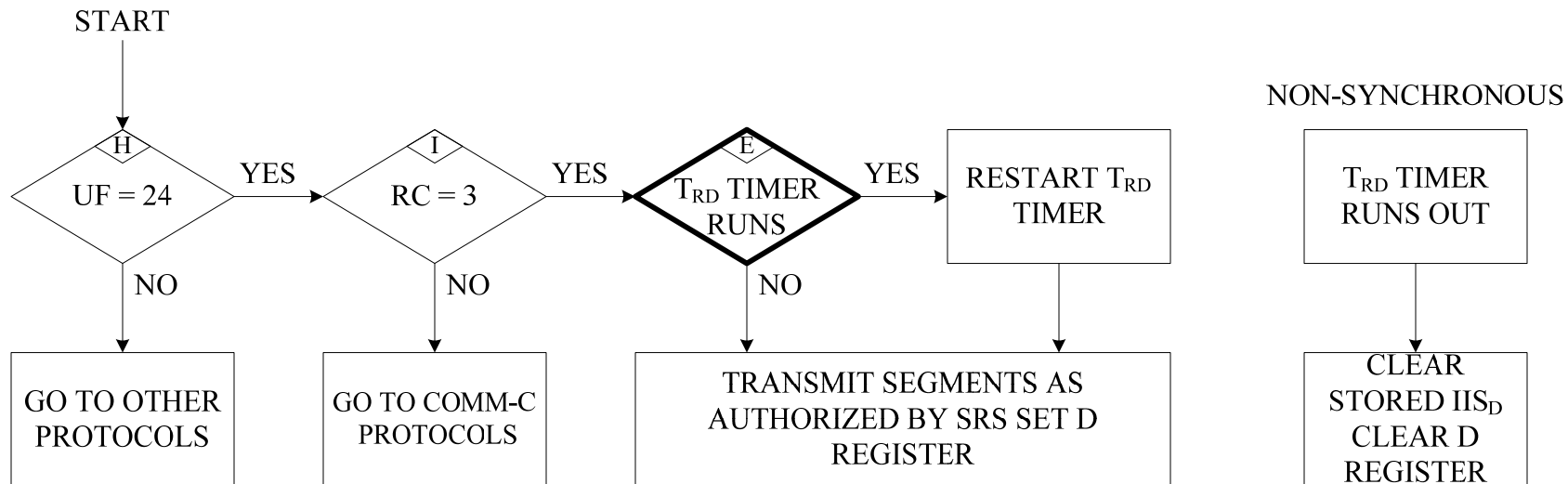


Figure 2-23: ORIGINAL FROM DO-181D, v1.1 in the Brussels Meeting

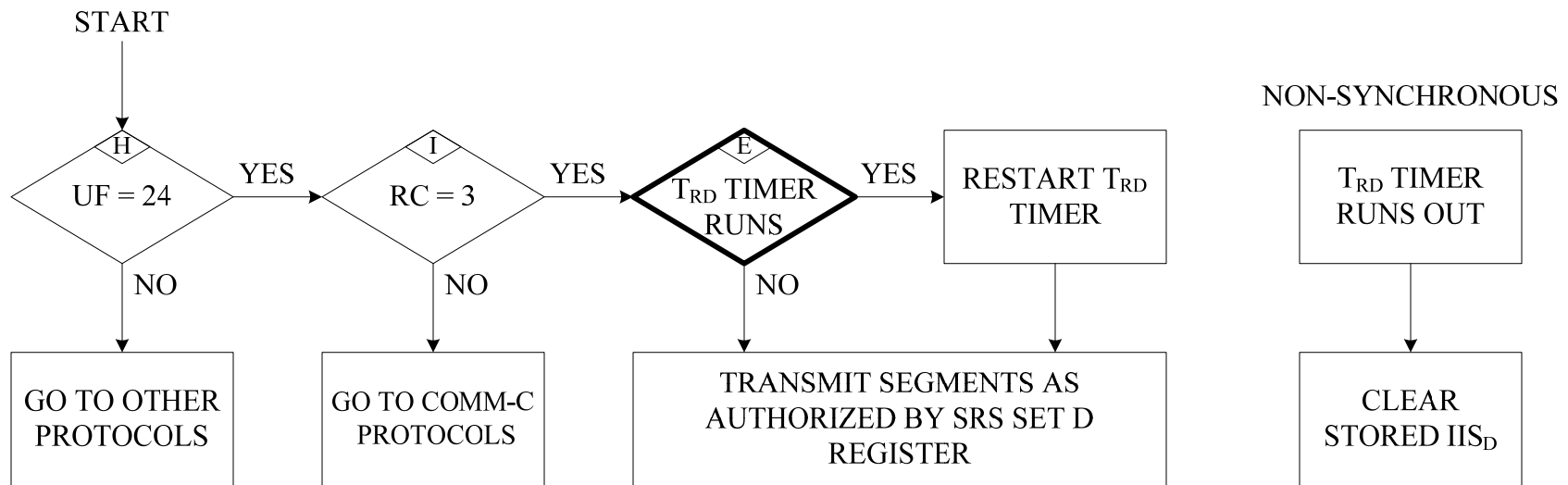


Figure 2-23R1: WITH CHANGES PROPOSED TO HARMONIZE WITH ED-73C Figure 3-22